UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

METRIS U.S.A., INC., METRIS N.V., METRIS IPR N.V., and 3D SCANNERS LTD. Plaintiffs, v. FARO TECHNOLOGIES, INC., Defendant.	CIVIL ACTION NO. 08-CV-11187-PBS

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER

May 4, 2011

Saris, U.S.D.J.

On July 11, 2008, the plaintiffs filed a patent infringement suit against defendant Faro Technologies ("Faro"), based on U.S. Patents No. 6,611,617 (the "'617 patent") and 7,313,264 (the "'264 patent"). The Court holds that the '617 patent is unenforceable due to inequitable conduct. Following a bench trial on this issue, the Court makes the following findings of fact and conclusions of law.

FINDINGS OF FACT

A. The Inventions

This case involves technology that enables users to scan and computer model three dimensional objects. Broadly, there are two ways of scanning a three-dimensional object. A scanning device can either use a probe to physically touch the object and measure the coordinates of points on its surface, or the device can rely on an optical probe. The most common method of optical scanning is laser triangulation, which involves the projection of a light source onto an object and the recording of the position of points on that object's surface when the light is reflected back to a recording device such as a video camera. (Pls.' Interactive Tech. Tutorial ("Pls.' Tut.").)

The scanning mechanism, whether it is a touch probe or a laser scanner, can be attached to an arm that moves around an object to image it from various perspectives. These arms can be multi-jointed to allow the scanner to move in six-degrees of freedom or they can be operated as a gantry that moves only in three dimensions: up, down, and side-to-side. The arms are operated by external computers, known as computer numerical control (CNC) systems, or they are manually operated. See generally Metris v. Faro Tech., 2009 WL 3447237, No. 08-11187 (D. Mass. Oct. 22, 2009) [hereinafter "Markman Order"] (for a more

detailed background on the technology at issue); (Def. Ex. 2 ("'617 Patent") at Abstract.) Specifically at issue in this matter are three patent claims relating to the mounting of a laser scanner on a manually operated multi-jointed, or articulated, arm.

The most vigorously contested of the claims at stake in this case is the synchronization and trigger technology ("sync and trigger") claimed by the '617 patent. This claim allows a laser scanner-arm combination to correlate the scanner's image data with position and orientation data retrieved from the arm. For the purposes of creating a three-dimensional image of an object, the data an optical or laser scanner captures is meaningless if the user cannot determine where the scanner was located relative to that object when it captured the image. This means that while a scanning device collects data on the object itself, it must also collect data on the position and orientation of the scanner.

When using a scanner attached to a movable, articulated arm, a potential source of error arises from the fact that a user moves the arm in unpredictable ways while scanning the object. This can result in the scanner-arm combination pairing image data with scanner position data slightly different from the actual position of the scanner at the time the image data was recorded.

Even very slight error in this regard can jeopardize the effectiveness of the technology, which depends on precision.

Sync and trigger aims to alleviate this problem by coordinating the capturing of scanner data with the recording of the scanner's position. In broad strokes, the technology works through a synchronization signal that defines the scanner's recording times and also initiates a trigger pulse that causes the arm to record position data at the same time as the scanner captures an image. See Markman Order at * 4; (see also Trial Tr. Day 4, 13:21-15:25; Day 5, 68:6-69:5.)

Claim one of the '617 Patent, which describes sync and trigger, reads as follows:

> [A] scanning apparatus for scanning an object to generate three-dimensional data, comprising a scanner mounted on a multiply-jointed arm for movement by an operator to scan the object to capture data from a plurality of points on the surface of the object, the scanner comprising:
>
> a light source operable to emit light onto the object surface; and
>
> a light detector operable to detect light reflected from the object surface by recording reflected light at recording times defined by a synchronization signal;
>
> a position calculator for calculating the position of the multiply-jointed arm, and outputting position data defining the position in response to a trigger pulse;

> a trigger pulse generator for receiving the synchronization signal for the light detector defining the recording times thereof, and, in response thereto, generating and outputting trigger pulses to the position calculator to cause the position calculator to output position data for each of at least some of the recordings by the light detector; and
>
> a three dimensional data generator for receiving recorded data output by the light detector and associated position data output from the position calculator, and for processing the data to generate three-dimensional data related to the object.

('617 Patent, col. 29, ll. 36-60.)

Also at issue in this case is the "dual mode" invention of the '617 Patent and the "processor in the head" invention of the '264 Patent. Dual mode describes the ability to use a controller to switch between two different data capture modes, an optical scanner and a tip probe, while scanning an object. As opposed to an optical scanner like a laser, which projects light onto an object and then records the reflection of that light in order to image the object, a tip probe physically touches a single point on the object's surface and gathers the point's three-dimensional coordinates. At times the tip probe will be a more useful measuring mode, for example in measuring deep recesses on an object's surface, and the dual mode invention allows users to switch between the two modes without having to physically change

the hardware attached to the scanner's head. Dual mode also involves the combination of data from both capture modes into a single three-dimensional image. (Trial Tr. Day 5 98:19-25; Pls.' Tut.)

The "processor in the head" invention involves the placement in the scanner head of a device "with a program" that can "process the electrical image data signals to generate processed data of reduced quantity." (Trial Tr. Day 5 100:5-6; '264 Patent, col. 30, ll. 14-15.) In simple terms, it allows the scanning device to process some of the hundreds of thousands of pixels captured by the optical scanner before sending that data to an external host computer. Along with other benefits, performing this operation in the scanner head makes the device easier to manufacture and install, reduces bandwidth, and improves the device's speed and efficiency. (Pls.' Tut..)

B. Conception

The following describes the conception of the claimed inventions, the state of the industry at the time the inventions were conceived, and the prosecution of the patents at issue. Because I find that 3D Scanners committed inequitable conduct in failing to disclose material information related to the sync and trigger claim, and that this misconduct makes the entire '617 Patent unenforceable, the following discussion does not address

prior art related to the dual mode invention. It does, however, include a brief discussion of prior art related to the processor in the head invention, which was addressed minimally at trial.

1. Collaboration with Faro

In 1991 Stephen Crampton ("Crampton") founded a small start-up company called 3D Scanners Ltd. ("3D Scanners") in the United Kingdom. The company focused on designing lasers to scan three-dimensional objects. Soon after its inception, it won a UK government research and development grant to work on laser stripe three-dimensional scanning technology. (Trial Tr. Day 2, 75:18-20.)

There are three main types of lasers that can be used to scan three dimensional objects: point scanners, stripe scanners, and area scanners. Point scanners work by projecting a single point of light on an object's surface. Though this type of scanner does not actually touch the object, like a touch probe, it can only gather information on a single point at a time. In contrast, a stripe scanner and an area scanner project multiple points of light onto an object's surface and capture image data by measuring the reflection of all of these points with an attached camera; an area scanner projects a circle of light, and a stripe scanner projects a long thin stripe. The capturing of multiple points of image data at a single time allows users to

scan objects much more quickly with a stripe or area scanner than they would be able to with a point laser scanner. (Pls.' Tut.)

Initially, 3D Scanners placed its stripe scanner on a three-dimensional gantry machine. (Trial Tr. Day 2, 78:19-25.) This device allowed a user to move the scanner around an object, but because a gantry machine only operates along three axes, the scanner could only image an object from above, and not from an angle. (Id.) In the early 1990's, 3D Scanners became aware of articulated arms that operated in six degrees of freedom. These arms would allow a user to move around an object to image it from various angles. (Id.) According to Crampton, the first articulated arm brought to his attention was produced by the U.S. company Immersion. (Trial Tr. Day 2, 79:6-7.) The Immersion scanner was about a foot long, and allowed a user to manually move around an object in six-degrees of freedom. (Trial Tr. Day 2, 9:25.) At the point when 3D Scanners became aware of the Immersion arm, however, it was operated with a touch probe that required a user to physically touch an object. (Id.) 3D Scanners believed that its laser stripe technology, then operating on a gantry machine, and the articulated arm technology, then relying on touch probes that required a considerable amount of time to scan an object and could not scan complicated surfaces, would

both be improved if they were combined in one device. (Trial Tr. Day 2, 80-81.)

Crampton testified that he formed this idea in 1992-1993 and that he began thinking about commercial opportunities to develop the product at least two years before any contact with Faro. (See Trial Tr. Day 2, 81:1-6, 82:2-11.) In an August 1994 communication with Faro, Crampton stated that 3D Scanners "ha[d] been looking for a commercial opportunity to interface to an arm-digitiser for over 2 years." (Def. Ex. 8.)

But Crampton was not the only industry player to conceive of the possibility of a laser scanner-articulated arm combination in the 1992-93 time-frame. Faro, a U.S. company that designed and manufactured scanning equipment including articulated arms, had not only conceived of the combination, but was taking substantial steps in the early 1990s to combine an articulated arm with a laser scanner. In February of 1993, Dr. Simon Raab, a co-founder of Faro applied for a patent on an articulated arm that employed a controller (or serial box) to pre-process the position of the arm. The application issued as a U.S. Patent No. 5,402,582 ("the '582 patent") in April of 1995. (See Def. Ex. 4 ("'582 Patent"), cols. 12-18.) Although this patent does not explicitly describe the mechanism through which an articulated arm communicates with a laser scanner, it does explain that the arm includes a number

of "voltage and analog-to-digital convertor lines for general attachment to a number of options such as a laser scanner device or a touch probe." (Id., col. 7, ll. 25-30.) The technology described in the '582 patent was embodied in Faro's Silver Arm 386. (Trial Tr. Day 1, 35:18.)

As it was developing its arm technology, Faro began communicating with laser scanner companies, including 3D Scanners, to see whether they were interested in mounting their laser scanners on Faro articulated arms. (See Trial Tr. Day 1, 42:25-56:4.) At this point, Faro had mounted touch probe scanners on articulated arms, but as Faro employee Allen Sajedi ("Sajedi") testified at trial, the "speed advantage of having a scanner at the end was enormous." (Trial Tr. Day 1, 56:1-3.)

On August 5, 1994, Gregory Fraser, the other Faro co-founder, faxed Crampton suggesting interfacing a 3D Scanners laser sensor with a Faro arm. In response, Crampton disclosed that he had been thinking about a similar combination and inquired about the interaction of the two technologies. He wrote:

> On the technical side, most of the work is probably down to us. I assume that your arm can output position and orientation of the head at 25 pts/sec? The sensor will need to be made very robust so that each time it is dropped it does not need repair/recalibration, or can you add a suspension arm and cords which would

equalize gravitational pull? We will then store 600 pts. @ 25 times/sec together with your x,y,z,i,j,k (or whatever); we can do this on our DSP card.

(Def. Ex. 8 (emphasis in original).)

Crampton's reference to the arm's output data recognizes the importance of recording orientation and position data. The fax also reveals that Crampton believed at least some of the technical challenges relating to the integration of the two devices would fall on 3D Scanners. (See id.)

Not long after this initial communication with Faro, Crampton expressed optimism about the possibility of mounting a stripe laser scanner on an articulated arm. In a memorandum written in September 1994, entitled "Arm-Based Stripe Scanning, A Discussion," Crampton discussed using a touch probe to scan an object and proposed an arm-based scanner. (Pls. Ex. 36.) The memo concluded by observing that "The market is there. The basic stripe data capture technology is there. A low-cost arm can be bought." (Id. at 4.) At trial, Crampton testified that his reference to a "low-cost" arm alluded to both the Faro Arm and an Immersion arm. The Immersion arm with which 3D Scanners was familiar in the 1992-1993 time frame was apparently too small to work effectively with 3D Scanners' technology, and 3D Scanners had contacted Immersion about the possibility of making a longer arm. (Trial Tr. Day 2, 82:15-19.) In 1994, Immersion informed 3D

Scanners that it was developing a longer arm that would be "very cheap." (Id. at 86:22-25.)

Specifically relevant to this dispute, the September 1994 memo included some general discussion of the problems the sync and trigger technology is meant to alleviate. Crampton wrote, "A stripe scanner would be mounted on a 6-axis arm. The scanner produces stripes of points at 25 stripes per second. The arm provides x,y,z,i,j,k sets at 125 times per second. The PC would need to store both stripe and position simultaneously and display on the screen the data as it is captured." (Pl. Ex. 36, at p. 2.) The memo does not, however, include a discussion of the specific issue of timing the capture of position and image data, nor does it describe the triggering of the arm or the synchronization of data collection in the arm and the scanner.

The difficulty of communicating between the scanner and the articulated arm became more apparent as 3D Scanners began working on the combination product. After its communication with Crampton, Faro sent 3D Scanners a loaner of one of its Bronze Metrecom arms, Faro's Caliper 3D software supporting the Faro arm from the host computer, and a manual for the arm. Sajedi also told 3D Scanners that he was available to answer questions about the arm and its interaction with a laser scanner. (Trial Tr. Day 1, 56:7-13.)

The manual included information on the operation of the Caliper 3D software, which allowed users to interface with the arm from the host computer by sending signals to the arm serial box. (Trial Tr. Day 1, 39:7.) This information included a description of the "Communication Commands" that the software sends to the serial box in order to communicate with and retrieve information from the arm. (See Def. Ex. 18, at 103.)

The most relevant communication command to this dispute is the _P command, which causes the arm to gather position data and includes a mechanism for flagging the position data that corresponds with image data captured by a laser scanner attached to the arm. Once the host computer sends the _P command to the attached arm, the arm, via its position calculator, responds with seven different parameters that allow the computer to record position data. The first parameter, known as "Errors and buttons," indicates a number of different pieces of information relevant to the collection of position data. Among this data is an indication of whether the arm has been "triggered" to record position data by an outside source seeking to capture an image at the same time. The _P command is sent out continuously, whether or not a synchronization signal has been transmitted, and the "Errors and buttons" parameter is crucial in "flagging" the position data that needs to be recorded because it corresponds

with image data captured by a scanner attached to the arm. (See Trial Tr. Day 1, 37-41, 53-60, 63-64.)

In addition to information about how the _P command works, the manual included information on command timing. (Def. Ex. 18., at p. 103.) A table included in the manual lists all of the communication commands and includes a table for "Max Time." (Id.) For the _P command, the table reveals a "max time" of "< 6.9 ms." (Id.) This means that position data will return no more than 6.9 milliseconds after the computer transmits an _P command. (Trial Tr. Day 1, 40:6-9.)

Faro also provided 3D Scanners with information concerning the hardware of the Faro arm that an "integrator" would need to know in order to send a synchronization signal from the scanner head to the arm. (See Def. Ex. 63.) Faro's Exhibit 63 provides an illustration of the kind of documentation Crampton and 3D Scanners received. This document begins, "3D scanning probes can synchronize their Video capture with Faro Arm position Capture using Faro Arm Option Port. Using Caliper3d Software or serial commands, you should enable the option port switch. . . . Supplying a low level TTL pulse to pin 3 of option port will capture the Arm position on the falling edge of the pulse." (Id.) The document also includes information concerning the signal that a scanner should send to four different versions of

the Faro Arm: the Silver Arm DSP, the Silver Arm 386, the Bronze Arm DSP, and the Bronze Arm 386. (Id.) For example, the diagrams state how long the synchronization signal should be "held low" for each version, and the frequency of the signal depending on its "baud rate." (Id.)[1]

Metris also likely received some type of electrical engineering diagram showing the voltage divider for the trigger pulse. (See Def. Ex. 195.) The information presented in the diagram was essential for interfacing between the arm and the

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[1] The parties dispute when 3D Scanners received a document like Faro's Exhibit 63. The document included in this record reflects that it was revised on "10/3/97," but Sajedi credibly testified that the first version of the document existed as early as 1992, when the Bronze Arm 386, one of the four arms discussed in the document, was released. Between that time and October 1997, the document was revised twice to incorporate data on Faro's updated versions of the arm. (Trial Tr. Day 1, 37:1.)

Some version of this document was given to 3D Scanners in 1995. (Trial Tr. Day 2, 42:5.) Given the fact that the information disclosed in these timing diagrams is critical to connecting a laser scanner to a Faro arm, (Trial Tr. Day 4, 58-59,) the Court finds ample reason to believe Sajedi's testimony. Moreover, even if an earlier version of this document did not arrive to 3D Scanners before the British patent application, Crampton and his colleagues had access to most of the critical information related to the Faro arm's hardware from other sources. For example, as described above, the Bronze manual lists the processor time for the arm serial box as 6.9 ms. Further, 3D Scanners received a Faro electrical schematic that teaches the voltage and pin locations for triggering. (Def. Ex. 195.) Finally, 3D Scanners own internal documents relate that at least some important information regarding the arm's hardware had arrived by summer 1995. In May 1995, Crampton noted that "FARO Interface, drawings arrived." (Def. Ex. 13, at p. 1.)

scanner because it communicated the option port and the signal specifications. (See Trial Tr. Day 5, 33:13-16.)

Metris argues that the Bronze Metrecom arm was not "triggerable" and that the first triggerable version of a Faro arm, the Silver Arm, did not reach Metris until 1996, after the submission of the British patent application. This argument is supported by a June 1996 fax from Crampton to Faro addressing the difficulty of triggering the Bronze Metrecom arm within the arm's hardware. (Pls. Ex. 24.) Further, at a deposition before trial Sajedi explained that "even though the [Metrecom arm] had the same option port, [it] did not have the same technology. . . The technology for triggering was not incorporated in that Bronze Arm." (Trial Tr. at Day 5, 17-18.) When confronted with this evidence at trial, Faro's expert Dr. Kurfess expressed confusion because other documents, including Exhibit 63, provided information on triggering the arm through the option port. (Id. at 18-19.) The Court finds, based on Sajedi's testimony and Crampton's June 1996 fax, that the Bronze Metrecom arm was not capable of triggering in the same way as the Silver Arm. However, it is not necessary to precisely determine the Bronze Arm's limitations, for as Dr. Kurfess explained, the Bronze Arm used the Caliper 3D software and its communication commands and included hardware features that suggested the possibility of

triggering. Moreover, as will be explained further below, there is evidence to suggest that Crampton was aware of the Silver Arm and its improved accuracy and triggering capabilities before the 1995 British patent application.

Although 3D Scanners worked with Faro on attaching a stripe laser scanner to a Faro device, 3D Scanners' ultimate vision was a laser stripe scanner that would be "arm agnostic." In March 1995, Stuart Hamilton, another 3D Scanners employee compiled a document entitled "Notes on a Manual, Non-Contact 3D Capture Device." (See Pls. Ex. 37.) This document described the mounting of a laser scanner on an articulated arm, a product 3D Scanners called the Data Creator. In the section of the document, titled "Position Sensing Device," the document noted, "The two most obvious candidates for position sensing device are both mechanical, though non-mechanical methods may be appropriate in the future, particularly for large parts. Various six-axis anthropomorphic arms are available onto which a sensor could be mounted." (Id.)

In April 1995, Hamilton wrote an application to a British governmental agency for funding for the further development of the Data Creator. The application explained that in order to function, the Data Creator relied on several components: a computer, a display, an arm, and a scanner. (Pls. Ex. 59.) It

also recognized that it was critical for the arm to send position data back to the computer in order to determine the position and orientation of the arm when image data was recorded. It noted, "There are several position sensing mechanisms commercially available based on a variety of technologies. They vary widely in accuracy, speed, size, and application. Therefore, a minimum amount of development (if any) will be performed in this area. An objective of the project will be to avoid any dependence on a particular position sensing device to allow for maximum flexibility." (Id. at p. 4.)

The application went on to describe the competition in the field. It set up a four-squared grid with two rows, one for manual arms and one for "powered" arms, and two columns, one for contact and the other for non-contact sensors. The manual, non-contact box, the box into which the Data Creator would fall, noted that non-contact, manual sensors are "fast, [and employ] a flexible process for completely 3D soft and /or detailed objects." (Id. at p. 6.) The document described Faro's own attempts to mount a non-contact scanner on an articulated arm: "The only company known to have made any attempt to produce a manual, non-contact 3D capture device is Faro Technologies who briefly tested a laser point probe in response to demand from the market. A Wolf and Beck laser point sensor was attached to a

Faro arm replacing the standard contact sensor. At this point the company realized that the software development required to take advantage of the speed and continuous operation of the laser sensor was outside its area of expertise and therefore decided not to develop the idea further." (Id.)

But despite its aspirations to create an arm agnostic scanner, 3D Scanners' energies and resources were directed primarily toward the combination of its scanner with a Faro arm. After Faro loaned its arm to 3D Scanners, the companies continued to discuss how to enable their technologies to communicate with each other. A team of 3D Scanners engineers, not including Crampton, visited Faro in 1994. (Trial Tr. Day 2, 19:16-25.) Of particular importance to the 3D Scanners engineers was the "registration" of a laser scanner to a Faro Arm. In order to mount any scanning device on an arm, an integrator must communicate with the arm regarding the orientation and size of the scanner in relation to the arm tip. In this way, the arm can extrapolate from its position and orientation to determine the position and orientation of the scanner head. 3D Scanners had registered its scanners to gantry machines that moved along three axes, but it had not successfully registered a scanner onto an arm that had six degrees of freedom. According to Sajedi, during the 1994 visit, he helped 3D Scanners engineers with the

mathematics necessary to determine how to register the scanner on an articulated arm. (Id.)

Crampton and 3D Scanners relied upon this information along with all of the materials passed on by Faro in developing a mechanism for interfacing between the Faro Arm and a 3D Scanners head. At this point, the Faro Arm was central to Faro's technological and strategic vision for the Data Creator. On June 21, 1995, Crampton noted that "Greg Fraser a Vice President of Faro Technologies, is coming to the UK next week. We have an appointment to demonstrate our progress to him on Wednesday June 28th. We need to impress him and hope to do so . . . ." (Def. Ex. 11.) Crampton's preparations for the Fraser visit emphasized the importance and difficulty of communicating between the arm and the scanner. According to the notes, "Colin and Phil [Hand a 3D Scanners engineer]" were to work on "Arm Interface," which included "Implemen[ting] the serial interface to the arm controller to allow arm locations and orientations and button hits to be captured." (Id.) Phil Hand alone was assigned to work on the "Arm-Sensor Data Combination" which involved "enabl[ing] sensor profiles and arm locations to be combined to produce profiles with which to populate a predefined range." (Id.) Furthermore, in an August 8, 1995 memorandum entitled "Interfacing and alignment of Data Creator with the Faro Arm,"

Crampton described accessing Faro's Caliper 3D software to set the baud rate, the communications port, and the _P command that signaled the Faro arm to send out its position coordinates. (See Def. Ex. 16; Tr. Day 3, 21-25.)

Despite all of these efforts, Crampton and 3D Scanners had trouble making the arm-scanner combination as accurate as they wanted it to be, and they reached out to Faro for more help. In an August 18, 1995 communication, Crampton wrote requesting a Silver Arm. (See Def. Ex. 17.) According to Faro's expert, Dr. Kurfess, the Silver Arm produced more accurate readings for three reasons. First, it sent position information to the host computer more quickly than the Bronze Arm. This made it easier to synchronize position data with image data from the scanner. Second, the Silver Arm's joints could more accurately measure orientation angles than prior arms. Finally, the Silver arm was "thermally compensated," which allowed the device to adjust for slight expansions and contractions of its component parts during temperature changes. (Trial Tr. Day 4, 33-34.) Despite Crampton's inquiry, Faro did not supply 3D Scanners with a Silver Arm until June 1996, nearly a year after Crampton's British patent application. (Id. Trial Tr. Day 4, 38.) During this period further development of the Data Creator was "restricted." (See Def. Ex. 198 (letter from Hamilton to Fraser stating that

"Data Creator development is restricted as we do not have an arm on site").)

In June 1996, Crampton sent Faro and Sajedi another fax regarding "problems getting accurate data out of the Faro Arm/ModelMaker sensor."[2] (See Pls. Ex. 24.) Crampton explained that "until today we have always assumed that errors were created by our hardware/software combination and that the Faro joint angles output has completely thrown us." (Id.) He continued, "I have one request: that we quickly try to resolve whether there is an error in the Faro joint angles output and its magnitude." (Id.) Although the fax does not relate specifically to the sync and trigger technology, it does more generally concern the interaction between the Faro Arm and the 3D Scanners scanner, and it also reveals how central the Faro Arm was to the ModelMaker project, even at this stage in the product's development. Crampton noted, "I am writing this while Phil Hand wrestles with the problems getting accurate data out of the Faro arm/ModelMaker sensor combination which he has put about 4 man-months of effort into so far." (Id.) He later explained, "If there is an error, the success of our $500,000 investment in the ModelMaker development is at this point in your hands." (Id.)

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[2] ModelMaker was the name 3D Scanners assigned to the Data Creator product at some point in 1996. (Trial Tr. Day 2, 121:4-6.)

Also in June of 1996, Crampton sent Sajedi a fax that discussed technological issues related to the sync and trigger invention. The fax recognized the importance of "trigger[ing the Faro arm] exactly when our sensor records a stripe." (Def. Ex. 21.) It also related that the 3D Scanners sensor could send a "trigger pulse within .5 msec of the sensor recording a stripe. . . ." (Id.) And went on "I remember what you said about the Bronze time error being significant eg 14 msecs and the Silver being very small." (Id.) The primary purpose of this fax, however, seems to have been to ask for specific information about how to trigger the Bronze Metrecom arm. Crampton noted that the Metrecom manual did not specify how to "trigger" the Metrecom arm to record position data. He then laid out three different possibilities for triggering the arm: "1. Hot-wiring the buttons with a relay; 2. Using the connector by the buttons . . . ; [or] 3. Using a connector on the controller box." (Id.)

2. A Joint Success

Even without the Silver Arm, 3D Scanners moved forward with the release and marketing of the Data Creator. When the Data Creator was first exhibited to the industry, 3D Scanners understood it primarily as a joint 3D Scanners-Faro project. An August 7, 1995 press release explains, "The two technologies on which the Data Creator concept is based were developed by 3D

Scanners and FARO Technologies."(See Def. Ex. 15.) A draft of this release was sent to Faro for approval on August 4, 1995, and on August 5, 1995 Stuart Hamilton wrote to Faro's distributor James Carne stating, "I enclose some publicity material for Data Creator, which we will be exhibiting as an on-going development with FARO in Los Angeles this week." (Def. Ex. 142; Trial Tr. Day 3, 9-10.)

However, over the next year, 3D Scanners also saw increasing potential for its laser to be attached to an Immersion arm. On June 18, 1996, Crampton took notes on the mechanism for triggering an Immersion arm. (See Pl. Ex. 43.) At that point 3D Scanners had acquired the longer Immersion arm that the company had discussed with 3D Scanners in 1994. (Trial Tr. Day 2, 118:11-18.)

In August of 1996, a new version of the Data Creator, now known as the ModelMaker, was exhibited at the SIGGRAPH in Los Angeles. In advertising the product, 3D Scanners placed less emphasis on its relationship with Faro than it had at the prior year's exhibition. In a 1996 press release it noted, "ModelMaker uses a hand-held laser stripe sensor to capture both 3D and color data from physical objects. The sensor is mounted on a conventional digitizing arm (Faro and Immersion are currently supported)." (Pls. Ex. 46.) Nonetheless, at the 1996

exhibition, the scanner head was displayed on a Faro arm. In a fax to Sumisho Electronics regarding the exhibition, Crampton wrote, "For the exhibition we will just use the standard serial cable between the Faro controller and the PC; please can you provide that. We do not use any Faro software (except that inside the controller box.)" (Def. Ex. 196.)

Over the next few years, the ModelMaker became increasingly commercially successful. At the 1996 exhibition the scanner was only compatible with Faro and Immersion, but it was eventually run on other articulated arms, including arms manufactured by a French company called Romer and a U.S. Company named SimCorp. (Trial Tr. Day 2, 122:3-5.)

In 2003, Faro came out with a competing product, giving rise to this litigation. (Id. at 122:16-23.)

C. Processor in the Head: Kreon

Kreon is a French company that designs and manufactures laser scanners. In May 1995, Kreon sued 3D Scanners in France for infringement on the French Cosnard Patent. (Trial Tr. Day 3, 47; see Def. Ex. 35 ("Cosnard Patent")(U.S. Patent No. 5,424,835 claiming priority to the French Cosnard patent).) This patent describes a laser scanner mounted at the end of a "manipulator arm." Faro argues that the patent discloses the "processor in the head" invention because it teaches the use of processor

circuits in the scanner head that can be used to "find the center of the line" projected by the scanner onto an object. (Trial Tr. Day 4, 46-48; Cosnard Patent, fig. 3.) The patent also teaches that this process can be implemented digitally. (Cosnard Patent, col. 7, l. 13.) The litigation between Kreon and 3D Scanners did not, however, focus on the processor in the head technology. Rather, it concerned the placement of mirrors inside the sensor for the purpose of bending light. (Trial Tr. Day 2, 127:12-14.)

D. The Prosecution of the Patents at Issue

On July 26, 1995, Crampton filed GB Application 9515311 (the "GB Application"). Crampton drafted the GB Application himself, he said, because he could not afford to hire counsel. (Trial Tr. Day 2, 106:11-21.) In the application Crampton disclosed the existence of multiply-jointed, manually operated arms, and noted that Faro was a supplier of such arms: "An example of such a manually operated arm is the Space Arm from FARO Technologies Inc., USA." (Pls. Ex. 41 (GB Application) at 8.)[3]

On July 25, 1996, Crampton filed PCT application PCT/GB96/01868 (the "PCT Application"), which claims priority back to the GB Application filed July 26, 1995. (Pl. Ex. 45

[3] A Space Arm is an early Faro arm, which is manually operated, does not have an option port for the connection of a laser scanner, and is triggered to record data through a foot pedal. (See Tr. Day 4, 48-49.)

("PCT Application").) Once again, Crampton did not use a lawyer to prepare the PCT Application. (Trial Tr. Day 2 118:19-119:12.)

After pursuing these patents, Crampton applied for U.S. patent protection. For his U.S. applications, he received the help of a British patent agency that itself used a U.S. patent agency. (See Trial Tr. Day 2, 123:14-20.) On May 26, 1998, he filed the U.S. application 09/000,215 (The "U.S. '617 Application"), which claims priority back to the GB and PCT Applications. This application issued as the '617 patent, entitled "Scanning Apparatus and Method," on August 26, 2003. On June 20, 2003, Crampton filed U.S.application 10/601,043 (U.S. '264 Application"), a continuation of the U.S. '617 Application. On December 25, 2007, this application issued as the '264 Patent, also entitled "Scanning Apparatus and Method."

1. Disclosed Prior Art and the Patent Office

The background of the '617 Patent discloses various examples of relevant prior art. It explains that arms can be manually operated or manipulated by computers, in what are known as CNC machines, ('617 Patent, col. 1, ll. 29-30), and that "[f]ew CNC machines are flexible enough so that the probe can be oriented in six degrees of freedom so as to scan the complete surface of an object," (Id., col. 1, ll. 57-59,) whereas manually operated arms "typically ha[ve] 6 joint axes." (Id. col. 2, ll. 35-40.) It

also describes, however, the error that arises as a result of scanning an object with an optical sensor attached to a manually operated articulated arm. Some of this error arises from the possibility that the scanner will capture image data when the arm is positioned at a different location than where it was positioned when its position was last recorded. (See id., col. 3, ll. 40-57.) This same error will not occur within a CNC operated scanner because those scanners will be programmed to record image data at pre-determined points in space. Position data will, thus, automatically be packaged with corresponding image data. (See Trial Tr. Day 5, 64:7-19.)

The '617 specification goes on to describe how to address this type of error in manually operated arms. It explains that some arms include position measurement systems and are capable of being triggered to record position data, whereas others do not have this feature. The preferred mechanism for ameliorating the timing problems in non-triggerable arms is to record the time at which image data and position data are recorded and extrapolate from the position data at the recorded time to the likely position of the scanner when the laser captured its data. (See id., col. 24, ll. 41-65.)[4] Where the arm is triggerable,

[4] The specification describes a process to "reduce the inaccuracy caused by the time difference between the recording of the arm position and the capturing of the fame [sic]" whereby

however, the '617 Patent notes that a synchronization signal can be transmitted from the camera to generate "a series of trigger pulses to the arm computer." (Id., col. 25, ll. 10-19.) "This has the advantage of eliminating both the arm and camera variabilities and increasing the accuracy of the scanning as much as possible for a given arm and camera." (Id.)

Along with laying out a general description of the scanner and arm technologies then available, the patent discloses some relevant prior patents. Among the patents disclosed is the Schulz patent, which describes a hand-held scanner that is not attached to an arm but, rather, is manipulated directly by the user. (See Def Ex. 26; Trial Tr. Day 5, 72-73.) The scanner feature of the invention operates similarly to the scanners at issue here. It includes a point scanner that projects onto an object and triangulates that point with an attached camera. Because the scanner is not attached to the arm, however, the device relies upon a different position capture mechanism that involves "optoelectronic" technology. The system works by projecting multiple lights in the area around the scanner and

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"the arm position before the frame is captured. . . is recorded. . .[;] [the] frame is requested. . . [;] the arm position after [the frame is recorded] is requested. . . [and] the arm position in the middle of the frame is estimated by interpolating in six degrees of freedom between the two arm positions. . . ." ('617 Patent, col. 24, ll. 47-65.)

triangulating from these lights the position of the scanner in space. (Trial Tr. Day 5, 73:1-13.) Importantly, however, the system does not disclose a mechanism for timing the capture of position and image data. Rather, it simply pairs the most recent position data with the most recent image data. (Id. at 75:7.)

During the prosecution of the '617 Patent, the patent examiner rejected a number of claims for being obvious.(See Def. Ex. 24, at pp. 2-6.) The examiner found that the Shulz patent disclosed a number of features relevant to optical scanning, including: 1) "a scanner for movement by an operator. . . to scan the object to capture data simultaneously from a plurality of points on the surface of the object. . . and detecting radiation reflected from the object surface. . .as the scanner is moved to different position[;]" 2) "a position detector for determining the position of the scanner;" and 3) "a modelor for processing data from the scanner and the position detector. . . to generate the three-dimensional computer model of the object." (Id. at 3-4.)

In response, on February 5, 2003, Crampton cancelled most of his pending claims. On March 4, 2003, the examiner considered the remaining claims and decided to issue the patent. In pertinent part his reasons for allowance were the following:

> [T]he cited prior art fails to teach or suggest the features of 'receiving the synchronization signal for the camera defining the image recording times thereof, and in response thereto, generating and outputting trigger pulses to the position calculator to cause the position [sic] to output position data for each image recorded by the camera.'

(Def. Ex. 139, at p. 2.)

Crampton failed to provide his attorneys or the examiner with any information regarding Faro's involvement in the Data Creator project. The U.S. patent attorneys were not provided with information regarding: (1) the Faro product manuals for the Bronze and Silver Arms; (2) Faro's Caliper 3D software; (3) 3D Scanners' press release stating that the Data Creator was based on Faro's technology; or (4) any information regarding the collaboration between Faro and 3D Scanners. (Morgan Dep. Tr:102-109.)

2. Crampton's Response

On March 12, 2003, after Crampton had been notified that the '617 Patent had been issued, he sent an email to two of his colleagues at 3D Scanners to discuss various options available to the company. "Option A" was to prevent anyone in the industry from using the technology "ie force everyone to not use sync ie be less accurate." (Def. Ex. 27.) This would involve suing competitors in U.S. court. In Crampton's eyes, winning such a suit "[was] potentially great because Faro believe optical probes

on the arm is their future." However, Crampton noted, "Faro may show us prior art early on in which case our patent has marginal value. . . [I]t all depends on existence of prior art; this is likely to be with Romer, Kreon, Perceptron or Faro as first players in the field." (Id.) Because of the possibility of prior art, Crampton also suggested as a possibility "Option B," which would involve "carv[ing] up the market with Faro." This would require "do[ing] a deal whereby Faro and we share the market and try to stop everyone else. . . [P]erhaps Faro keeps prior art quiet (if any)." (Id.) Crampton believed that this strategic business decision was of critical importance to the future of the company. He wrote to his colleague "please can you give us ideas before you go away; this is one of the most crucial decisions in the company's history." (Id.)

Metris seeks to avoid the inference that Crampton was aware of prior art and purposefully failed to disclose it by arguing that references to the "possibility" of prior art can be interpreted to signal a lack of certainty regarding its existence. This argument is unpersuasive, particularly in light of the fact that I found Crampton's testimony to be intentionally misleading in a number of respects. In a video recording of a deposition, which Faro's counsel played at trial, Crampton denied that Faro had played any role in interfacing its arm with third-

party scanners or, even, that Faro had designed its arms so that they could be interfaced with a third-party scanner, in stark opposition to the evidence presented at trial. (Trial Tr. Day 3, 15:18-20.) Moreover, Crampton expressed an excessively narrow understanding of prior art, at times seeming to suggest that only technology that would directly infringe a patent is relevant prior art to that patent's application. (Trial Tr. Day 2, 134-135.) Finally, when confronted with the email, Crampton disclaimed any memory of sending it, which seems unlikely given the fact that Crampton believed that the email laid out one of the most crucial decisions in 3D Scanners' history. (Trial Tr. Day 3, 74-75.) Overall, Crampton's testimony reflected, at the very least, a willful blindness toward his relationship with other companies in the development of the technology at issue and his responsibilities under the law.

Application of Law to Facts

A. Standard

Patents are government-sanctioned monopolies awarded to inventors in order to incentivize innovation. "The far-reaching social and economic consequences of a patent, therefore, give the public a paramount interest in seeing that patent monopolies spring from backgrounds free from fraud or other inequitable conduct and that such monopolies are kept within their legitimate

scope.” Precision Interest Mfg. Co. v. Automotive Maintenance Machinery Co., 324 U.S. 806, 816 (1945).

In order to ensure that patent examiners have all of the information they need to make weighty decisions about what inventions merit patent protection, the law applies a duty of candor to all patent applicants. See Fox Indus. v. Structural Preservation Sys., Inc., 922 F.2d 801, 803-04 (Fed. Cir. 1991); Hycor Corp. v. Schlueter Co., 740 F.2d 1529, 1538 (Fed. Cir. 1984). This duty extends throughout the patent's entire prosecution history and applies to all contacts with the PTO during the course of the prosecution. See 37 C.F.R. § 1.56. If an applicant breaches this duty and thereby commits inequitable conduct, the entire patent resulting from the application is rendered unenforceable, even if the inequitable conduct related to only one of the patent's claims. See Kingsdown Med. Consultants Ltd. v. Hollister, Inc., 863 F.2d 867, 877 (Fed. Cir. 1988)(en banc).

In order to prove inequitable conduct, an alleged infringer must establish by clear and convincing evidence that the patent applicant “(1) made an affirmative misrepresentation of material fact, failed to disclose material information, or submitted false material information;” and (2) that the applicant intended to deceive the PTO. See Lazare Kaplan Int’l, Inc. v. Photoscribe

Tech., Inc., 628 F.3d 1359, 1377-78 (Fed. Cir. 2010)(internal quotation marks and citations omitted). "If a court concludes that a threshold level of materiality and intent to deceive has been proven by clear and convincing evidence, the court must then 'balance the equities to determine whether the applicant's conduct before the [PTO] was egregious enough to warrant holding the entire patent unenforceable.'" (Id.)(quoting Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 537 F.3d 1357, 1365 (Fed. Cir. 2008)).

The law regarding materiality is in flux. See Therasense v. Becton Dickinson and Co., 2008-1511, 2008-1512, 2008-1513, 2008-1514, 2008-1595, 2010 WL 1655391, at * 1 (Fed. Cir. April 26, 2010) (allowing a petition for a rehearing en banc to address a number of issues including "3. What is the proper standard for materiality? What role should the United States Patent and Trademark Office's rules play in defining materiality? Should a finding of materiality require that but for the alleged misconduct one of more claims would not have issued?"). As it stands today, however, the Federal Circuit imposes a "reasonable examiner" standard on parties claiming that undisclosed information was material to a patent application. Under this test, "[i]nformation is material when a reasonable examiner would consider it important in deciding whether to allow the

application to issue as a patent." Symantec Corp. v. Computer Associates Intern., Inc., 522 F.3d 1279, 1297 (Fed. Cir. 2008) (internal quotation marks and citations omitted). "Material information is not limited to information that would invalidate the claims under examination." McKesson Information Solutions, Inc. v. Bridge Medical, Inc., 487 F.3d 897, 925 (Fed. Cir. 2007)(citing Li Second Family, 231 F.3d 1373, 1380 (Fed. Cir. 2000)).

The PTO Rules also aid in determining what undisclosed information is material to a patent application. Rule 56 provides that an applicant has a duty to disclose information that is material to patentability and states that

> "(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
>
> (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
>
> (2) It refutes, or is inconsistent with, a position the applicant takes in:
>
> (i) Opposing an argument of unpatentability relied on by the [PTO], or
>
> (ii) Asserting an argument of patentability."

Golden Hour Data Systems, Inc. v. emsCharts, Inc., 614 F.3d 1367, 1374 (Fed. Cir. 2010)(citing 37 C.F.R. § 1.56(b)).

To satisfy the intent prong of inequitable conduct, "the involved conduct, viewed in light of all the evidence, including

evidence indicative of good faith, must indicate sufficient culpability to require a finding of intent to deceive.” Elsai Co. Ltd. v. Dr. Reddy’s Labs., Ltd., 533 F.3d 1353, 1360 (Fed. Cir. 2008)(citations and quotations omitted). An alleged infringer need not come forward with direct evidence of intent, but intent to deceive must be the “single most reasonable inference that can be drawn from the evidence.” Lazare Kaplan Intern., Inc. v. Photoscribe Tech., Inc., 628 F.3d 1359, 1381 (Fed. Cir. 2010).

B. Sync and Trigger

1. Materiality

Before the materiality of undisclosed information can be addressed, it is necessary to elucidate the contours of the sync and trigger claim. Cf. Trovan, Ltd. v. Sokymat SA, Irori, 299 F.3d 1292, 1302 (Fed.Cir.2002)(“Moreover, an inventorship analysis, like an infringement or invalidity analysis, begins as a first step with a construction of each asserted claim to determine the subject matter encompassed thereby.”). The examiner’s reasons for allowing the ‘617 Patent noted that the prior art “fails to teach or suggest the features of receiving the synchronization signal for the camera defining the image recording times thereof, and in response thereto, generating and outputting trigger pulses to the position calculator to cause the position to output position data for each image recorded by the

camera." This description is consistent with the language of the claim, which describes a device for "receiving [a] synchronization signal," and, in response, "outputting trigger pulses to the position calculator to cause the position calculator to output position data for at least some of the recordings by the light detector." The Court understands this language to refer to the temporal integration of image and position data accomplished through real time communication between the scanner and the arm during the capturing of image data while a user manipulates the arm around an object.

At times during this litigation, Faro seemed to urge a broader interpretation of the invention to encompass the entire interface between a laser scanner and a movable articulated arm. For example, Faro continually emphasized its role in "registering" the scanner head to the six-degree of freedom arm. This process is critical to the integration of the arm and scanner in space, but it does not bear directly on the sync and trigger claim, which concerns the integration of the two devices in time. For this reason, the Court does not address the materiality of Faro's role in registering the two devices.

At the same time, the technology includes more than the mere transmission of a synchronization signal, as Metris has at times suggested. The synchronization signal is only useful to the

extent that it "cause[s] the position calculator to output position data for each image recorded by the camera." Central to the invention, therefore, is a mechanism for ensuring that the synchronization signal results in the recording of contemporaneous (or near contemporaneous) position information. Furthermore, although the specification makes reference to both triggerable and non-triggerable arms, the language of the claim, in that it refers to the "generating and outputting [of] trigger pulses to the position calculator," describes the functioning of sync and trigger on a triggerable arm. A triggerable arm is, thus, integral to the sync and trigger technology

When the sync and trigger claim is understood this way, the relationship between Faro's technology and the claim is relatively straightforward. Both Faro and Metris' experts explained that the sync and trigger process is initiated by a synchronization signal, which causes the scanner head to capture image data and communicates with the arm regarding the recording of position and orientation data. The transmission of the synchronization signal occurs outside of the arm, but the actual mechanism for recording position and orientation data occurs within the arm, its position calculator, and the host computer. In 1995, the Faro Bronze and Silver Arms were prompted to record position data through the transmission of the _P command within

Faro’s Caliper 3D software. (See Trial Tr. Day 5, 114-16.)(Metris’ expert admitting that “one way one could trigger the arm and get position data is to make use of the underscore P command”).)

At trial, Dr. Kurfess testified extensively about the importance of _P to sync and trigger. In the version of the technology described by Dr. Kurfess, the host computer or the scanner continually transmits a synchronization signal to the arm and the scanner. (See Trial Tr. Day 4, 20:4-16.) In response, the scanner captures video data. Simultaneously, the computer sends the _P command via Faro’s Caliper 3D software. The return of position data is not necessarily directly timed with the transmission of the synchronization signal, so the position data and video data, the latter of which is captured directly in response to the synchronization signal, are not initially timed. The “errors and buttons” parameter is crucial in synchronizing this data. It “flags” position and orientation data transmitted from the position calculator to the host computer immediately after the synchronization signal. In this way, the host computer can coordinate the video data with the most relevant position and orientation data. (See id., 10-20.)

Also relevant to sync and trigger is hardware connected to the Faro arm. First, the position calculator allows for the

recording and transmission of position data in response to the _P command. Second, the option port on the end of the scanner allows the scanner to capture data simultaneously with the synchronization signal. (Id. at 16:3-7.) In this way, another source of error, the delay between the synchronization and video capture, can be eliminated.

Successfully connecting with the Faro Arm in order to perform sync and trigger also requires an integrator to know information about the arm's hardware. This information includes the pin onto which the synchronization signal should be sent, the appropriate frequency of the signal, and the timing of data collection. Some of this information, like the pin and frequency information, is essential to knowing how to send a synchronization signal into the arm. Other information, including information relating to the timing of data collection and recording, may not be essential to sending a signal but is essential to predicting the error that results from integrating position and image data. For example, as Faro's expert testified, knowing how long it takes to retrieve position data after an _P command is sent enables an integrator to determine the maximum amount of time that will lapse between the capture of image data and the next collection of position and orientation data. (Id. at 58:9-20.)

The question presented by this case is the significance of the relationship between the Faro arm and sync and trigger. Are the Caliper 3D software, the arm hardware, and information relating to the connection between a laser scanner and the Faro arm material to the sync and trigger invention? Or, as Metris argues, are they merely relevant to one possible commercial embodiment of the sync and trigger technology?

Upon consideration of the evidence, I conclude that these features are material to questions of inventorship and obviousness and, thus, should have been disclosed to the patent examiner.[5] See 35 U.S.C. §§ 102(f), 103. Even if the '617 Patent

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[5] Faro has also argued that 3D Scanners failed to meet the best mode requirement by not disclosing that sync and trigger worked best on a Faro Arm with the Caliper 3D software. See 35 U.S.C. § 112. The Federal Circuit has explained that "[c]ompliance with the best mode requirement is a question of fact, which involves a two-pronged inquiry. The first prong is subjective, focusing on the inventor's state of mind at the time he filed the patent application, and asks whether the inventor considered a particular mode of practicing the invention to be superior to all other modes at the time of filing. The second prong is objective and asks whether the inventor adequately disclosed the mode he considered to be superior." See Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1332 (Fed. Cir. 2002). Although the inventorship discussion below explains that in 1995 3D Scanners focused considerable resources on integrating its scanner with a Faro arm, there is also evidence that Crampton subjectively intended for the scanner, and the sync and trigger claim, to be arm agnostic, which undermines Faro's assertion that Crampton's preferred best mode involved the Faro arm and the Caliper 3D software. Given the importance of the Faro arm to the operation of sync and trigger at the time of the British patent application, however, the question is an extremely close one. The Court need not reach the issue because it finds that the patent is unenforceable for other reasons, namely inequitable

would still have been issued had the full extent of 3D Scanners relationship with Faro been disclosed to the patent office, Faro has established by clear and convincing evidence that a reasonable patent examiner would have considered this information important in making her decision.

a) Inventorship:

The touchstone of the inventorship analysis is conception. Conception involves "the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice." Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed.Cir.1986) (citation omitted). However, "[c]onception is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." Burroughs Wellcome Co. v. Barr Laboratories, Inc., 40 F.3d 1223, 1228 (Fed. Cir. 1994).

Though Faro's relationship with 3D Scanners may not have prevented the examiner from issuing the patent to Crampton alone, it would have been important information for a reasonable patent examiner. Even assuming that Crampton conceived of the idea of

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conduct in failing to disclose information relating to inventorship and obviousness.

sending a synchronization signal into the arm, the sync and trigger invention cannot be reduced to practice without somehow ensuring that position data will temporally match video data, and this can only happen if the mechanism for capturing position data is coordinated with the synchronization signal. The errors and buttons parameter accomplishes this coordination. There is no evidence that Crampton or anyone with ordinary skill in the art could have provided a substitute mechanism that would have allowed him to reduce the conception to practice. See Caterpillar Inc. v. Sturman Indus., 387 F.3d 1358, 1377 (Fed. Cir. 2004)("[Joint inventorship] requires more than merely exercising ordinary skill in the art – 'a person will not be a co-inventor if he or she does no more than explain to the real inventors concepts that are well known [in] the current state of the art.'" (alterations in original)). In fact, Metris' expert could not conceive of any other way of retrieving position data from a Faro arm.

There is no question that Crampton was aware of this information before he submitted his British patent application. Crampton's notes from June 21, 1995 reveal that triggering the arm through use of its serial interface, which would have involved the Caliper 3D software, was the most effective way of retrieving position information. Moreover, Crampton's memo from

August 1995 relates that 3D Scanners engineers relied upon the Caliper 3D software in communicating with the arm. Although this document post-dates the priority date by a few weeks, it suggests that 3D Scanners was familiar with the software well before the priority date and that _P, and the errors and buttons parameter in particular, were bound up with Crampton's understanding of how to time the recording of position and image data to the extent that this understanding had developed by the time of the British patent application.

It is true that the Caliper 3D software and the _P command do not constitute the entire invention, but this does not mean that they do not raise questions about inventorship. Even where a putative joint inventor has not played a role in the conception of the entire invention, he or she can still be a joint inventor as long as he or she "(1) contribute[s] in some significant manner to the conception or reduction to practice of the invention[;] (2) make[s] a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention[;] and (3) do[es] more than merely explain to the real inventors well-known concepts and/or the current state of the art." <u>Pannu v. Iolab Corp.</u>, 155 F.3d 1344, 1351 (Fed. Cir. 1998). There is little doubt here that the Caliper 3D software and the _P command

constituted a significant contribution to the conception of the invention. As Crampton's notes from 1995 reveal, the development of the combined Faro/3D Scanners product relied upon the Caliper 3D software and information obtained from the manuals and timing diagrams passed on by Faro and Sajedi. This information and materials were critical in performing one of sync and trigger's most important functions, matching arm position data with the most recently captured image data.

Metris raises a number of counter-arguments. First, it argues that the sync and trigger conception pre-dates any collaboration with Faro and that communications with Faro involved, merely, enabling the scanner to function on one of the arms with which it was potentially compatible. See Ethicon v. U.S. Surgical Corp., 135 F.3d 1456, 1460 (Fed. Cir. 1998)("One who simply provides the inventor with well-known principles or explains the state of the art without ever having a 'firm and definite idea' of the claimed combination as a whole does not qualify as a joint inventor." (citations omitted)). This argument fails for two reasons. First, Crampton could not have conceived of the invention until he began collaborating with Faro. As the '617 Patent specification makes clear, the invention assumes the existence of a triggerable arm, the capability to trigger the arm and the information necessary to

determine whether this triggering would allow for the increased accuracy sync and trigger was intended to achieve. Crampton's frequent communications with Faro, including his June 1996 correspondences regarding the Metrecom arm's triggering capabilities and the Silver arm, suggest that Crampton would not have been able to bring the conception to practice without the involvement of an arm manufacturer with the technology and know-how to trigger an arm in response to a synchronization signal.

Second, the Faro arm was not just any arm. Dr. Kurfess testified that during the 1995 time-frame, Faro was one of the two "big dogs" in the market, the other being Romer. (Trial Tr. Day 4, 50:22-23.) It was also the only arm capable of being triggered during this time frame. The hardware triggering feature was not available on the Romer and Immersion arms until after Crampton had submitted the British patent application. (Id. at 50:51-52.) This means that at that time only the Faro Arm enabled a user to perform sync and trigger within the hardware of the arm, as opposed to relying on external computer software to match data using the interpolation technique described above. (Id.) Moreover, the press release issued by 3D Scanners in August 1995 relating to the Data Creator as a joint Faro-3D Scanners project belies the notion that sync and trigger, as it was initially conceived and executed, was truly arm agnostic. In

July 1995, to the extent sync and trigger had been conceived and implemented, it worked exclusively on a Faro arm.

Metris also points to Nartron Corp. v. Schukra U.S.A. Inc., 558 F.3d 1352 (Fed. Cir. 2009), and Hess v. Advanced Cardiovascular Sys., Inc., 106 F.3d 976 (Fed. Cir. 1997) to support the argument that a party who provides support in executing an invention, or helps to improve an invention by supplying an important component part existing in the prior art, cannot be an inventor. In these cases, however, though the contributions of the alleged co-inventor may have improved the invention, the contributions were not central to the inventions' core ideas in the way that Faro's contributions were to sync and trigger.

In Nartron, the Federal Circuit held that a party claiming to have contributed the addition of a "lumbar support adjuster," a technology already present in the market, was not a co-inventor on a patent protecting a control system relating to the massage functionality of car seats. Nartron, 558 F.3d at 1356. In arriving at this conclusion, the court held that the lumbar support adjuster was insignificant relative to the entire invention. Id. at 1357. The court wrote: "[T]he specification of the patent makes clear that the automobile seat, including its lumbar support adjustor and extender, comprises the existing

object on which the invention (i.e. the control module) operates, or the background of the invention." Id. The heart of the invention in that case was the "control module," and the addition of the lumbar support adjustor was an improvement easily accomplished by someone with ordinary skill in the art. Id. In contrast, here, the heart of the sync and trigger claim includes a mechanism for ensuring that the arm records the position data most contemporaneous with the image data. At the time of the British patent application, to the extent that this function was possible, it was performed in part by the Caliper 3D software and the _P command. It is true that the Caliper 3D software pre-dated the conception of the invention, but this does not mean that Faro's contribution was the mere provision and explanation of prior art on to which Crampton's inventive efforts operated. Faro supplied the technology that became much of the basis for the invention. One of ordinary skill in the art could not have triggered the Faro arm without the Faro software and Faro's aid.

In Hess, the court held that an engineer who explained to two physicians the materials that they could use in developing a balloon angioplasty catheter was not a co-inventor of their invention. Hess, 106 F.3d at 981. The court's conclusions were supported by the district court's factual findings that the alleged co-inventor's contribution amounted to "nothing more than

explaining to the inventors. . . the then state of the art and supplying a product to them for use in their invention . . . . The principles [he] explained to them were well known and found in textbooks. [And he] did no more than a skilled salesman would do in explaining how his employer's product could be used to meet a customer's requirements." Id. Although Hess may be more similar to the case at hand than Nartron in that the material for the angioplasty balloon was, like the Faro arm, critical to the successful embodiment of the invention, Faro's contributions to sync and trigger were more significant than the plaintiff's contributions to the invention in Hess. In Hess, the plaintiff supplied the claimed inventors with raw materials and explained how these materials could be manipulated using technologies familiar to those with ordinary skill in the art. In contrast, here, Faro supplied Crampton and 3D Scanners with a product that actually performed part of the process patented in the sync and trigger claim. Furthermore, Faro's collaborative contributions amounted to more than describing well-known technologies. As Crampton's frequent communications with Faro during the 1994-1996 time frame reveal, matching position and image data through sync and trigger on a 3D Scanners-Faro joint product was difficult and would not have been attainable without Faro's proprietary software and hardware, which were not, at that point, replicable

by one with ordinary skill in the art.

The Court acknowledges that the inventorship issue here is not clear-cut. Metris' objections highlight some of the reasons why a patent examiner might not have concluded that Faro should have been among the named inventors of the '617 Patent, namely the fact that, in theory, the sync and trigger technology could operate on arms that did not use the Caliper 3D software or the specific hardware in place on the Faro arm. As the above discussion explains, however, there are a number of reasons why this argument misses the mark, including the fact that 3D Scanners focused its energies on synchronizing its scanner with a Faro arm and the considerable role that Faro's technology, and the Caliper 3D software and _P command in particular, played in the execution of sync and trigger. These factors support a conclusion that even if the patent would have been issued regardless of whether Faro's full collaboration had been disclosed, such information would have been important to a reasonable patent examiner.

The Federal Circuit's opinion in <u>Perseptive Biosystems, Inc. v. Pharmacia Biotech</u>, 225 F.3d 1315 (Fed. Cir. 2000), is illustrative of this point. In that case, the Federal Circuit affirmed the district court's finding of inequitable conduct where the named inventors on a patent protecting a perfusive

chromatography process did not disclose that another group had "supplied the materials and data that were critical to the named inventors' understanding of the [invention]." Id. at 1319. The alleged co-inventors supplied the particles that "were the genesis of the inventions" and "worked in close collaboration" in researching these particles. Id. Over the objection of a strongly worded dissent, which noted that the alleged co-inventors "did not initiate and did not conduct the[] studies" that focused on whether these particles had a "throughpore" structure that would aid chromatography, id. at 1325-26 (Newman, J. dissenting), the panel majority concluded that "[a] full and accurate disclosure of the true nature of the relationship between [the named inventors] and the [alleged co-inventors]. . . would have been 'important' to a reasonable examiner's consideration of the inventorship question." Id. at 1322. Similarly, here, even if a patent examiner were to conclude that the provision of the Faro arm and the software, along with support in the development of sync and trigger on the Faro arm, would not have constituted co-inventorship, this information would have been important to the inventorship analysis. Like the inventions in PerSeptive, Crampton received important materials and information concerning these materials that were closely related to both the conception and the embodiment of the claim at

issue.

b) Obviousness:

In KSR Intern. v. Teleflex, Inc., 550 U.S. 398 (2007), the Supreme Court set out a flexible test for determining whether an invention was obvious and, therefore, unpatentable. The Court explained that "[i]n determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim." Id. at 419. The Court went on to resuscitate the obvious-to-try test, which had been eschewed by the Federal Circuit: "When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103." Id. at 421.

KSR also signals a return to the factors the Supreme Court had outlined in Graham v. John Deere Co. of Kansas City, 383 U.S. 1 (1966), in determining whether an invention is obvious. Under this approach "[T]he scope and content of the prior art are . . .

determined; differences between the prior art and the claims at issue are . . . ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." See KSR, 550 U.S. at 399 (quoting Graham, 383 U.S. at 17-18). KSR, thus, "expanded the sources of information for a properly flexible obviousness inquiry to include market forces; design incentives; the 'interrelated teachings of multiple patents'; 'any need or problem known in the field or endeavor at the time of the invention and addressed by the patent'; and the background knowledge, creativity and common sense of the person of ordinary skill." Perfect Web Tech., Inc. v. Infousa, Inc., 587 F.3d 1324, 1329 (Fed. Cir. 2009)(citing KSR, 550 U.S. at 48-21). But the Court warned, "A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning." See KSR, 550 U.S. at 421.

Under this framework, it is highly possible that a patent examiner would have found the sync and trigger invention to be

obvious had Faro and Crampton disclosed information about the Caliper 3D software and Faro's triggerable arms. Although most obviousness cases concern the combination of pre-existing elements, a new addition to a pre-existing technology can also be obvious if the pre-existing technology seems to suggest such an addition to a person with ordinary skill in the art. For example, in Perfect Web the Federal Circuit held that a patent on a method of managing bulk email distribution to targeted customers was made obvious by a prior method which included the first three steps of the subsequent process, where the fourth step involved merely "repeating earlier steps." Perfect Web, 587 F.3d at 1330. The court first held that the addition of the fourth step involved nothing more than common sense that would have been obvious to someone of ordinary skill. Id. Second, the court held that the addition would have been obvious to try because "simple logic suggests" that repeating the prior three steps would be the most effective way of addressing the problem the patent sought to overcome. Id. at 1331.

The parties in this case have not fully briefed or argued the Graham factors, and, thus, a full-blown obviousness inquiry is not attainable, but neither is it required. The undisclosed information comes close enough to making the sync and trigger claim obvious that any reasonable patent examiner would have

found the information important in making a decision on patentability. For example, the _P command allows for the retrieval and recording of position data, and includes in its first parameter a mechanism for flagging recently captured position information. Based on this feature, a patent examiner may have found that it would have been “common sense” for someone with ordinary skill in the art to integrate a Faro arm with a laser scanner through the transmission of a single synchronization signal that would set video capture recording times.

Furthermore, the existence of Faro triggerable arms including position calculators, might suggest the sending of a syncronization signal to time the capture of position data. As late as June 1996, Crampton was still having problems figuring out how to perform the triggering function. His fax to Sajedi from this period lays out various possible mechanisms for sending a signal to a Bronze Metrecom arm. It is not clear how this problem ultimately resolved, but it seems that once Crampton received the Silver Arm, he no longer had the same problems triggering through the option port. Metris argues that this evidence supports its position that, in regard to accepting synchronization signals transmitted by an external source, the Faro arm's technology was not fully developed in 1995, when

Crampton submitted his British Patent application. The communication also reveals, however, that Crampton's efforts were complicated mainly by the limitations of the Metrecom arm. Once he had a Silver Arm with more advanced hardware, the sending of a synchronization was apparent and easily accomplished. An examiner might have concluded that the triggering capabilities of the Faro Silver Arm in particular suggested the transmission of a single synchronization signal. Even if the arm Crampton had in 1995 could not be easily triggered, by the time he applied for his British patent, he was aware of the existence of a Silver Arm with the more advanced hardware. This information, thus, could and should have been disclosed to the patent examiner.

Even if the existence of the software and the arm hardware would not have dictated the use of a single synchronization signal to solve the problem sync and trigger aimed to resolve, it would seem that such a solution would be "obvious to try." Once again, the problem with mounting a laser on an articulated arm is that position data will be captured at different times from image data. By 1995, Faro had developed an arm with the capability to be triggered through an option port, an attached position calculator, and most importantly software that enabled the position calculator to flag the last recorded position data. It would seem obvious to at least try using a single synchronization

signal to capture image data and retrieve position data, relying on the position calculator to record the position and the _P command to flag the relevant data.

c) Information provided to the patent examiner:

Before finding that the non-disclosed information meets the "threshold level" of materiality, the Court must perform a "detailed factual analysis of the relevance of the [undisclosed] teaching[s]. . . both with respect to the claims of the patents-in-suit and with respect to the other prior art references that were before the examiner." Dayco Products, Inc. v. Total Containment, Inc., 329 F.3d 1358, 1367 (Fed. Cir. 2003). The undisclosed information would not have been cumulative of the information before the examiner, and, thus, Crampton had a duty to disclose it.

First, the Schulz patent is not nearly as relevant to the sync and trigger claim as the Caliper 3D Software or Faro's triggerable arms. Schulz teaches a scanner head that can record its position by projecting multiple points of light and triangulating its own position in space. Even if this device struggles with the same timing problems as a laser scanner attached to an articulated arm, the Schulz patent does not teach a mechanism for pairing image data with position data. It operates by automatically pairing the image data with the most

recent position data. Moreover, the Schulz patent does not include a position calculator or any of the other hardware elements involved in the capturing and recording of the position of an articulated arm.

Second, the general disclosure of triggerable arms does not adequately disclose Faro's contributions to the Data Creator. The prior art and collaboration with Faro extended far beyond the mere existence of triggerable arms. Also relevant would have been specific information about how the arms were triggered and the existence of the triggerable Faro arms and the Caliper 3D software. Moreover, citing the existence of triggerable arms does not disclose the existence of a mechanism for matching position data with a synchronization signal, part of the core of the invention. This mechanism was performed in part by the _P command's "Errors and Buttons" parameter within the Caliper 3D software. The fleeting general description of the existence of triggerable arms, therefore, does not come close to disclosing the extensive reliance on Faro and the Faro Arm in executing sync and trigger. See Agfa Corp. Creo Prods., Inc., No. Civ.A. 00-10836, 2004 WL 1882623, *25 (D. Mass. Aug. 24, 2004)(finding assertions that the "Background generally disclosed prior art [] references to not be credible, particularly in light of their knowledge of relevant competitor. . .machines at the time of the

applications”).

Finally, the references to the Faro Space Arm in the British patent application do not satisfy the duty of candor. These references are not nearly as relevant to sync and trigger as the later versions of the Faro Arm. According to Faro’s expert, the Space Arm is a “tinker toy.” It does not have the option port, the trigger buttons or position calculator required to trigger an arm within its hardware, or the Caliper 3D software. (Trial Tr. Day 4, 49:14.) This is not the case with even the Metrecom arm, which 3D Scanners acquired in 1994. (Trial Tr. Day 5, 16:11-15.) And it certainly was not the case with the Silver arm, with which 3D Scanners was certainly familiar by July 1995.

2. Intent

In this case, the intent prong of inequitable conduct, which is often the most difficult prong for an accused infringer to meet, is a much less difficult question. Crampton’s email, combined with his evasive testimony at depositions and trial, provide clear and convincing evidence of his intent to deceive the patent office. The language of the March 12, 2003 email supports the conclusion that Crampton believed “Option B” was the most attractive choice. Under “Option A,” Crampton acknowledged that “Faro may show us prior art early on in which case our patent has marginal value.” In contrast, “Option B” allowed 3D

Scanners to avoid the costs of litigation and receive many of the benefits of a valid patent even if prior art had not been fully disclosed. Moreover, Crampton's reference to Faro "keeping prior art quiet," suggests his notably cynical understanding of the strategic choice facing 3D Scanners at that time.

Specifically relevant to Crampton's intent to deceive with regard to the sync and trigger technology, it is apparent that by the time he filed his British patent application, he was familiar with Faro and its technology, was aware of the _P command and the Caliper 3D Software, sought a Faro Silver Arm to improve the execution of sync and trigger, and marketed the initial Data Creator as a joint Faro-3D Scanners project. Moreover, Crampton's initial deposition testimony that he did not believe the Faro arm in his possession in 1994-1995 even had a port for mounting a laser scanner, was so beyond the scope of credibility that it suggests awareness that Faro and collaboration with Faro might present significant difficulties in this matter. Finally, the fact that under "Option B" Crampton makes numerous references to "keeping Faro happy" implies that Crampton was highly nervous about Faro's ability to challenge the validity of the '617 Patent. Crampton was intimately aware of the substantial importance Faro's technology had to the sync and trigger invention. This awareness, along with his anxiety about Faro's

legal claims, suggests that Crampton "made a deliberate decision to withhold [the] known material reference." See Optimum v. Emcore Corp., 603 F.3d 1313, 1320-21 (Fed. Cir. 2010).

C. Dual Mode

Because inequitable conduct makes an entire patent unenforceable even if it relates to only one of the patent's claims, the entire '617 patent, including the dual mode claim, is unenforceable. Therefore, the Court need not address the materiality of undisclosed materials relating to dual mode.

D. Processor in the Head

The '264 Patent, which includes the processor in the head invention, is a continuation of the unenforceable '617 patent. The Federal Circuit has found that continuation patents may be unenforceable due to inequitable conduct in the prosecution of the patent application. See Agfa Corp. v. Creo Prods, Inc., 451 F.3d 1366, 1380 (Fed. Cir. 2006) ("[I]nequitable conduct 'early in the prosecution may render unenforceable all claims which eventually issue from the same or a related application.'" (quoting Fox Indus., Inc. v. Structural Preservation Sys., 922 F.2d 801, 804 (Fed. Cir. 1990)); Consolidated Aluminum Corp. v. Foseco International Ltd., 910 F.2d 804, 809-12 (Fed. Cir. 1990) (patentee's inequitable conduct in prosecuting initial patent permeated the later improvement and continuation patents and

rendered all of them unenforceable)). However, not all later applications are "tainted by the inequitable conduct of earlier applications." Agfa, 451 F.3d at 1379 (citing Baxter Int'l, Inc., v. McGaw, Inc., 149 F.3d 1321, 1332 (Fed. Cir. 1998)). The test for determining whether a continuation patent is infected with inequitable conduct in the earlier application is whether the "inequitable conduct that occurred earlier in the chain. . .[is] related to the targeted claims of the ultimately-issued patent or patents sought to be enforced." eSpeed, Inc. v. BrokerTec USA, L.L.C., 417 F.Supp.2d 580, 595 (D. Del. 2006)(citations and internal quotation marks omitted). "Were this not the rule, a party committing inequitable conduct could avoid the consequences of that conduct through a scheme of divisional and continuation applications. The law does not countenance such a manipulation of the patent process." See Semiconductor Energy Lab. Co., Ltd. v. Samsung Elec. Co., Ltd., 24 F.Supp.2d 537, 543-44 (E.D.Va. 1998).

The possibility that the '264 Patent might be tainted by the inequitable conduct underlying the '617 Patent has not been argued or fully briefed by the parties. At this point, the Court finds that although the '264 Patent is similar to the '617 Patent, and as a continuation patent, shares its priority date, Faro has not established an immediate and necessary relationship

between the inequitable conduct relating to sync and trigger and the '264 patent application. Therefore, the '264 patent is only unenforceable if Faro has established independent inequitable conduct in prosecuting that application.

In regard to this question Faro has failed to meet its steep burden in establishing by clear and convincing evidence that Crampton understood that undisclosed information relating to the processor in the head invention needed to be submitted to the patent examiner. Faro argues that the Cosnard '764 Patent, the basis for the Kreon-Faro litigation, discloses a "data processor" in the scanner housing. Crampton certainly knew about the existence of the French '764 Patent, but his attention with regard to that patent was focused on the issues at stake in the litigation with Kreon, including the use of mirrors in the scanner head. Even if this patent discloses a processor in the head,[6] Faro has not established that Crampton intended to mislead the patent office with regard to the processor in the head claim.

E. Equitable Factors

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[6] Dr. Hager testified that the Cosnard patent did not disclose the processor in the head invention because it disclosed a "digital circuit" as opposed to a device or program. (Trial Tr. Day 5, 100.) It is not necessary for the Court to address this question, because it finds that even if the Cosnard patent was material, Faro has failed to establish an intent to deceive the PTO with regard to the processor in the head claim.

Because the Court finds that a threshold level of materiality and intent has been met with regard to the sync and trigger claim, it must determine whether consideration of the multitude of equitable factors counsels in favor of holding the ‘617 Patent unenforceable.

Although the impact of finding this patent unenforceable may seem harsh, it is necessary to protect the integrity of the patent application process. Metris argues that if the patent is invalidated, it would mean that every inventor would have to disclose all of the actors with whom he works on executing an invention. Metris’s assertion minimizes the importance of Faro’s collaboration with Crampton and 3D Scanners. Faro was not just one of the companies with which Crampton had to work in order to manufacture and market his invention. Its technology accomplished a significant piece of the sync and trigger invention, and, at the time of the British patent application, it was the only company that could supply a triggerable arm. This sort of collaboration must be disclosed to the patent office in determining whether a patent should be issued.

Moreover, rarely is evidence of intent as apparent as it is here. Crampton’s email and testimony clearly reveal that he knew that Faro’s collaboration was significant and that it should have been disclosed to the patent office.

ORDER

The Court finds that Crampton committed inequitable conduct in prosecuting the sync and trigger claim and holds the ‘617 Patent unenforceable.

/s/ PATTI B. SARIS
PATTI B. SARIS
UNITED STATES DISTRICT JUDGE